



Regional Programmatic Approach on Climate Action (RPACA)

Annex 22: Preliminary GHG Assessment Methodology Note

September 2026

SUMMARY

The Regional Programmatic Approach to Climate Change Action (RPACA) is an ADB strategic initiative aimed at mobilizing large-scale climate finance from the Green Climate Fund (GCF) for Pacific Small Island Developing States (SIDS), covering 14 participating countries (refer Table 1).

As part of this initiative, a program-level greenhouse gas (GHG) assessment has been undertaken to estimate the potential emission reductions from selected projects across key sectors including Agriculture, Food, Nature, and Rural Development (AFNR), Energy (ENE), Human Settlement and Development (HSD), Transport (TRA), and Water & Urban Development (WUD). This assessment note presents a consolidated summary of the GHG mitigation potential.

The RPACA program is fundamentally designed through a climate adaptation and resilience lens to support Pacific SIDS. As such, climate mitigation outcomes associated with the proposed investment pipeline are considered climate mitigation co-benefits rather than the primary objective of the overall program. The present assessment therefore focuses on estimating indicative ex-ante GHG mitigation potential associated with selected investments under the program pipeline where measurable mitigation impacts could reasonably be identified at this stage of program preparation.

Table 1. Country-wise Indicative Projects summary

S.No.	Country	Number of Indicative Projects
1	Cook Islands	1
2	Federated States of Micronesia	1
3	Fiji	1
4	Kiribati	1
5	Nauru	2
6	Niue	1
7	Palau	2
8	Papua New Guinea	2
9	Republic of Marshall Islands	2
10	Samoa	2
11	Solomon Islands	2
12	Tonga	1

13	Tuvalu	1
14	Vanuatu	2
Total		21

Out of the 21 projects (refer Table 2), eight projects have been excluded from the analysis, as they are fully adaptation-focused, health sector-related, or planning projects with no potential mitigation activities that produce direct, quantifiable GHG mitigation impacts, which is a core requirement for inclusion in GHG accounting exercises. The exclusion reflects a methodological boundary: only projects with explicit, direct, and quantifiable GHG mitigation effects (such as renewable energy generation, energy efficiency improvements, or fuel switching) were included in the assessment, whereas projects focused on adaptation, resilience, or institutional strengthening were screened out due to the absence of attributable mitigation outcomes.

Table 2. Indicative Project wise summary

Description	Number of Indicative Projects
Total number of indicative projects	21
Excluded projects from GHG analysis (refer Annex 1 of this document)	8
Remaining projects taken for GHG analysis	13

The GHG assessment has therefore been conducted for the remaining 13 projects, covering the AFNR, ENE, TRA, and WUD sectors (refer Table 3).

Table 3. Summary of Indicative projects for GHG analysis

Mitigation sector	Number of Indicative Projects
AFNR	2
ENE	2
TRA	1
WUD	8
Total	13

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Methodologies applied:

The GHG assessment for the selected 13 **indicative** projects based on ADB pipeline proposed for RPACA in the Pacific region has been carried out using a combination of internationally recognized tools, methodologies, and guidelines to ensure consistency, transparency, and robustness of results. Sector-appropriate methodologies and tools were applied depending on the nature of the activity.

- Mangrove restoration and conservation activities were assessed using the FAO [EX-ACT Tool \(v.9.4.2\)](#) to estimate changes in carbon stocks and emissions/removals associated with land-use management.
- Renewable energy generation and transmission & distribution efficiency improvements were assessed using UNFCCC Clean Development Mechanism (CDM) [ACM 002 \(v.22\)](#) methodology and [Tool 5](#), including the approach for grid-connected renewable electricity generation and electricity displacement.
- Water supply and sanitation interventions were assessed using ADB technical guidance note on assessing GHGs¹ by comparing emissions associated with existing service delivery systems and proposed improved systems.

The analysis is also aligned with the Intergovernmental Panel on Climate Change (IPCC) Guidelines, internationally recognized GHG accounting practices, ADB technical references and covers GCF requirements to support consistency, robustness and transparency in ex-ante estimation at an early stage of program development. The assessment was undertaken on an ex-ante basis using currently available project information. Where detailed data were not yet available, conservative assumptions were applied to ensure that mitigation benefits were not overstated.

Overall approach and limitations:

The assessment has been undertaken at a programmatic level using currently available project concept information and indicative assumptions. The estimates therefore represent indicative ex-ante GHG mitigation potential associated with the identified pipeline at this stage of preparation and may evolve as individual investments advance through feasibility assessment, detailed engineering design, and project appraisal processes.

The assessment primarily estimates GHG emission reductions (avoided) compared to baseline scenarios representing likely without-project conditions. Baseline scenarios have been developed using sector-specific assumptions consistent with available country conditions, technology pathways, and existing data references.

¹ Technical Guidance Note for Borrowers and Clients on Assessing Greenhouse Gas Emissions of Projects Financed by the Asian Development Bank

Sector-wise GHG analysis:

AFNR

There are two projects under AFNR sector. These projects focus on coastal protection and rehabilitation through nature-based solutions (NbS). Based on the available project information, mangrove restoration has been assumed as the primary mitigation activity.

The baseline scenario is considered as a condition of high mangrove degradation, reflecting continued loss of mangrove cover and associated ecosystem services in the absence of the project. The project scenario is considered as low mangrove degradation, where restoration and conservation measures improve mangrove health and enhance carbon sequestration potential.

Key assumptions:

- a) The GHG analysis has been conducted using the FAO's [EX-ACT tool \(v.9.4.2\)](#).
- b) A lifetime of 30 years has been considered for the analysis
- c) Climate, soil, and moisture parameters have been selected in the EX-ACT tool based on country-specific data
- d) The area of mangrove restoration is assumed based on the total mangrove extent available within each country.
- e) In the EX-ACT tool, the forest degradation levels are assumed as “*Moderate*” under the existing condition, expected to witness “*Extreme*” degradation under the without-project scenario, and assumed to be contained to “*Very Low*” degradation under the with-project scenario.

ENE

There are two projects under ENE sector. Based on the available information, these projects involve renewable energy (RE) generation, implemented with or without battery energy storage systems (BESS).

For RE projects, the electricity demand in the baseline scenario is non-existent in remote island communities or met through existing grid power, which is typically fossil fuel-based. In the project scenario, renewables are installed or existing grid electricity is replaced by renewable energy generation integrated with/without BESS, resulting in a reduction in GHG emissions. Grid emission factors have been considered based on the default values recommended by the IFI Technical Working Group (IFI TWG).

Assuming an energy project in the Pacific is primarily designed to strengthen resilience and energy security, with mitigation benefits as a co-benefit, improved and more reliable electricity access can act as a critical enabling platform for a wide range of economic and social activities².

² Prasad, R. D., Chand, D. A., Lata, S. S., & Kumar, R. S. (2025). *Beyond energy access: How renewable energy fosters resilience in island communities*. *Resources*, 14(2), 20.

This enhanced energy reliability supports the development and expansion of local enterprises that generate both direct financial returns and broader community-level benefits, including improved livelihoods, service delivery, and overall socio-economic resilience.

In the context of Pacific Island countries, strengthened and more dependable electricity supply can enable the diversification and scaling of key economic sectors such as tourism, fisheries, and agricultural production, which are central to both domestic consumption and export-oriented activity. It can also reduce vulnerability associated with fuel import dependence by improving energy security and supporting partial displacement of fossil fuel reliance where feasible.

Key assumptions:

- a) A lifetime of 30 years has been considered for the analysis
- b) For RE projects, the target capacity for benefits is considered based on the country's NDC target or installation cost assumptions
- c) Access to reliable electricity facilitates in remote and outer island communities catalyzes the use of modern equipment, processing facilities, and improved supply chain infrastructure. These investments in the alternative scenario therefore enhance product quality and value addition, thereby strengthening local enterprise development and community resilience.
- d) Lifetime benefits of renewable energy deployment support entrepreneurship, improve business continuity under climate and external shocks, and contribute to more resilient and sustainable community and economic systems across the Pacific island communities.

TRA:

There is only one project under TRA sector, which involves the upgradation of airport infrastructure. As part of this project, solar-based power generation is considered to support the airport's energy requirements.

In the baseline scenario, the electricity demand is met through fossil fuel dominated grid power. In the project scenario, this demand is met through rooftop solar electricity generation installed to support the airport infrastructure, thereby reducing reliance on grid electricity.

Key assumptions:

- a) A lifetime of 30 years has been considered for the analysis
- b) The installation of 1 MW rooftop solar integrated with BESS is considered

WUD:

There are eight projects under WUD sector. Based on the available information, four indicative projects involve both water supply and sanitation improvements, while the remaining four projects focus solely on water supply activities. The baseline and project scenario for these projects are given in Table 4.

Table 4. Baseline and project scenario

Project type	Baseline scenario	Project scenario
Water supply	Water supply through trucks	Water supply through pipelines
Sanitation	Wastewater treatment in open lagoons	Centralized wastewater treatment plant

Key assumptions:

- a) A lifetime of 30 years has been considered for the analysis
- b) The GHG calculation is done based on the assumption that the target beneficiaries cover 20% of the country's population

Note on Emissions Monitoring

RPACA is fundamentally an adaptation-focused programme, and the GHG emission reductions presented in this Annex are indicative ex-ante estimates of mitigation co-benefits derived from the indicative investment pipeline rather than mitigation targets. Project -level GHG reduction targets and associated MRV requirements have not been established for sub-projects as this would not be consistent with the adaptation focus of the programme and would require Pacific SIDS executing entities to define mitigation interventions and monitoring arrangements from the outset, potentially triggering additional ESS9 requirements and constraining the optimization of adaptation outcomes.

However, where substantive and quantifiable mitigation co-benefits are identified during project preparation, climate due diligence, or ESS9 screening, appropriate GHG accounting and monitoring arrangements will be established and documented through the programme general management information system (GMIS). This is consistent with applicable ADB climate assessment, monitoring, safeguard, and ESF requirements. GHG parameters and achieved emission reductions will be monitored only for those sub-projects where material and quantifiable mitigation co-benefits are identified and can be robustly assessed.

For sub-projects with identifiable and quantifiable GHG mitigation co-benefits, the GMIS will include a GHG co-benefits record. Where applicable, the record will document: (i) baseline and project scenario assumptions; (ii) applied methodology and version; (iii) project boundary; (iv) commissioning and operating period; (v) monitored activity data; (vi) emission factors and underlying data assumptions/sources; (vii) estimated baseline, project and net

emissions avoidance/reductions; (viii) cumulative reductions achieved; (ix) deviations from ex-ante estimates and explanations; and (x) supporting evidence and validation records.

Overall summary:

Based on the above analysis and assumptions, the aggregated GHG mitigation potential is estimated to achieve total annual emission reductions of 104,850 tCO₂e/year, resulting in cumulative emission reductions of approximately 3.14 million tCO₂e over their respective project lifetimes (refer Table 5). These estimates reflect indicative program-level GHG emission reductions associated with the indicative pipeline of projects with identifiable mitigation impacts. The estimates are intended to provide an initial indication of the potential climate mitigation co-benefits of the RPACA investment pipeline and should not be interpreted as detailed project-level GHG assessments.

While the estimated mitigation impact of 3.14 million tCO₂e over the project lifetime is modest in global terms, it is significant within the Pacific SIDS context, where countries have very low emissions but face disproportionate climate risks. The emissions reductions complement the RPACA's primary objective of strengthening climate resilience, while also supporting energy security, reducing dependence on imported fossil fuels, and contributing to national and regional low-carbon development pathways. For an adaptation-focused programmes, this level of mitigation should be viewed as an important co-benefit of the RPACA rather than the primary objective.

As individual investments progress through project preparation and detailed design, each project will be subject to applicable ADB climate and [Environmental and Social Framework](#) requirements, including [Environmental and Social Standard 9 \(ESS9\) on Climate Change](#), as relevant. At that stage, more detailed project-specific GHG assessments will be undertaken, including estimation of absolute and relative GHG emissions.

Table 5. Overall country summary

S.No.	Country	No. of indicative projects for GHG analysis	Annual GHG Emission Reductions (tCO ₂ e/year)	Lifetime GHG Emission Reductions (tCO ₂ e)
1	Cook Islands	1	860	25,793

S.No.	Country	No. of indicative projects for GHG analysis	Annual GHG Emission Reductions (tCO ₂ e/year)	Lifetime GHG Emission Reductions (tCO ₂ e)
2	Federated States of Micronesia	1	5,424	162,727
3	Fiji	No projects	-	-
4	Kiribati	No projects	-	-
5	Nauru	2	5,495	164,842
6	Niue	No projects	-	-
7	Palau	1	69	2,072
8	Papua New Guinea	1	41,850	1,255,505
9	Republic of Marshall Islands	1	1,731	51,926
10	Samoa	1	883	26,487
11	Solomon Islands	1	40,006	1,200,167
12	Tonga	1	399	11,967
13	Tuvalu	1	481	14,417
14	Vanuatu	2	7,654	229,608
Total		13	104,850	3,145,513

Appendices

APPENDIX 1. Excluded projects from GHG analysis

Table A1 provides a list of projects that have been excluded from the GHG assessment along with the justification for their exclusion from the analysis. These projects were screened out based on their scope and nature with no direct or measurable GHG mitigation potential.

Table A1. Excluded projects

S.No.	Country	Sector	Project name	Remarks
1	SAM	TRA	Resilient road network project	Project is 100% adaptation
2	KIR	HSD	Indicative Climate-Resilient Health Infrastructure Strengthening	Project is focussed on health, no mitigation activities
3	NIU	HSD	Indicative Climate-Resilient Social and Aged Care Infrastructure	Project is focussed on health, no mitigation activities
4	RMI	HSD	Indicative Health Systems Strengthening (Ebeye)	Project is focussed on health, no mitigation activities
5	SOL	HSD	Indicative Climate-Resilient Education Infrastructure Enhancements	Project is focussed on education improvement, no mitigation activities
6	PNG	TRA	Indicative Climate-Resilient Highlands Transport Corridors	Project is 100% adaptation
7	PAL	WAT	Indicative Water-Energy System Sustainability Improvements (PPUC)	Project is focussed on planning and infrastructure upgrades, no mitigation activities
8	FIJ	TRA	Indicative Critical Bridges Resilience Project	Project is 100% adaptation

Appendix 2: Sensitivity Analysis on Indicative Sub-project “Urban Water and Sanitation Resilience Enhancements (Provincial Towns)” in Papua New Guinea

A sensitivity analysis was conducted to evaluate the influence of key baseline assumptions on the estimated GHG emission reductions from the wastewater component. The analysis assessed the impact of variations in the beneficiary population, the proportion of wastewater treated in open lagoons under the baseline scenario, and the baseline methane correction factor (MCF).

Analysis result:

Under the base case assumption of 20% project beneficiaries, 100% of wastewater treated in open lagoons, and a baseline methane correction factor (MCF) of 0.8, the project achieves an estimated annual GHG emission reduction of **104,850 tCO₂e/year** and a lifetime emission reduction of **3,145,513 tCO₂e**.

The sensitivity analysis demonstrates that the **highest emission reductions** (+35%) of 141,721 tCO₂e/year and 4,251,622 tCO₂e over the project lifetime are achieved under the scenario with 25% project beneficiaries, 100% of wastewater treated in open lagoons, and a baseline MCF of 0.9. Conversely, the **lowest emission reductions** (-42%) of 60,730 tCO₂e/year and 1,821,911 tCO₂e over the project lifetime occur under the scenario with 15% project beneficiaries, 80% of wastewater treated in open lagoons, and a baseline MCF of 0.7. These results indicate that the estimated GHG emission reductions are sensitive to variations in the beneficiary population, the proportion of wastewater treated in open lagoons under the baseline scenario, and the baseline MCF. Following figures illustrate the sensitivity analysis results for each case.

Figure 1. Sensitivity analysis of GHG emission reductions under a constant baseline MCF of 0.8 (Case 1)

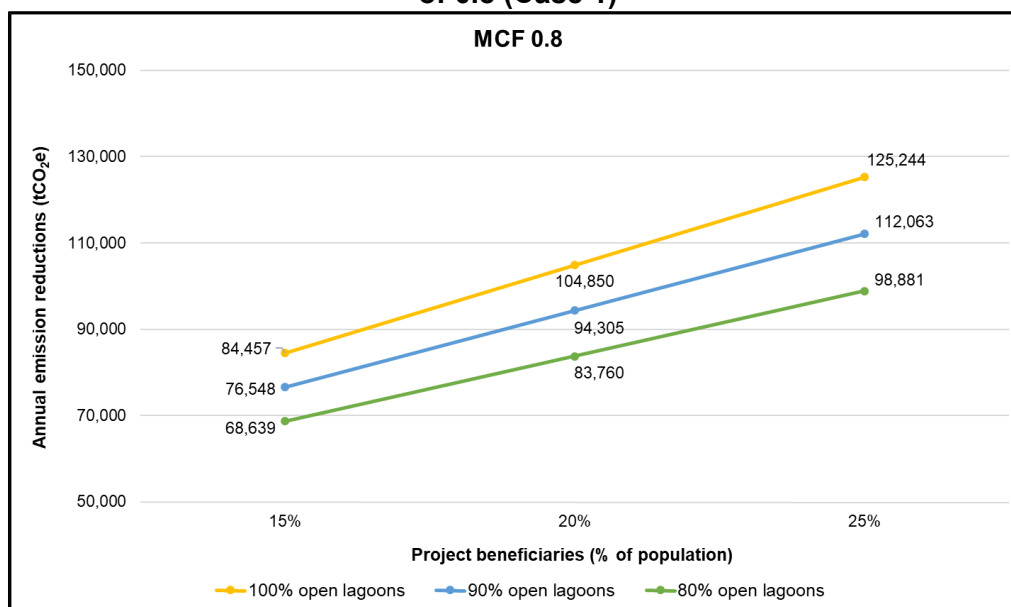


Figure 2. Sensitivity analysis of GHG emission reductions under constant baseline MCF of 0.7 (Case 2)

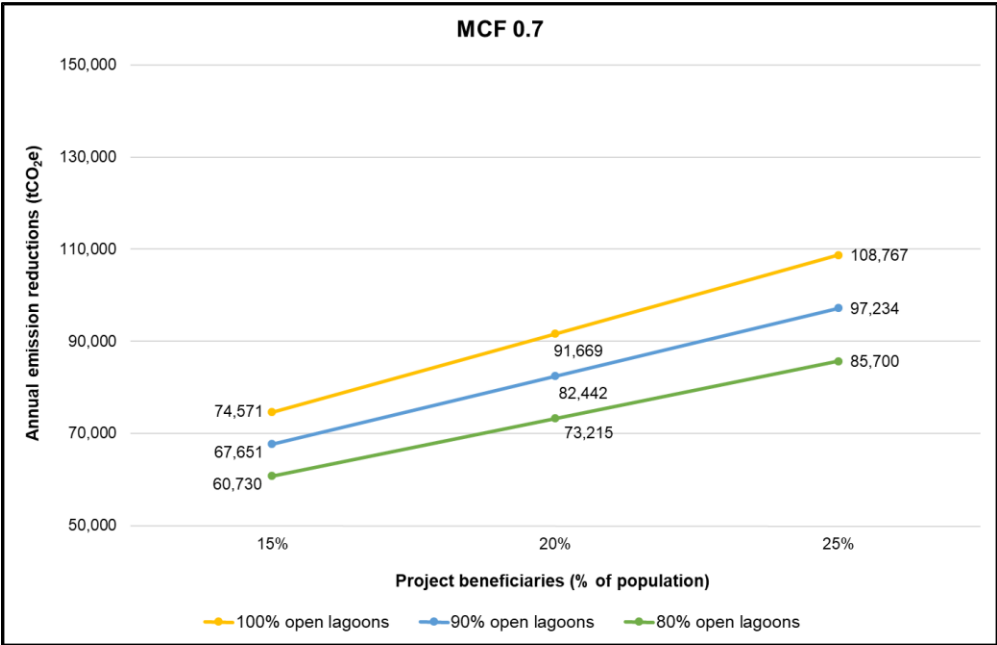
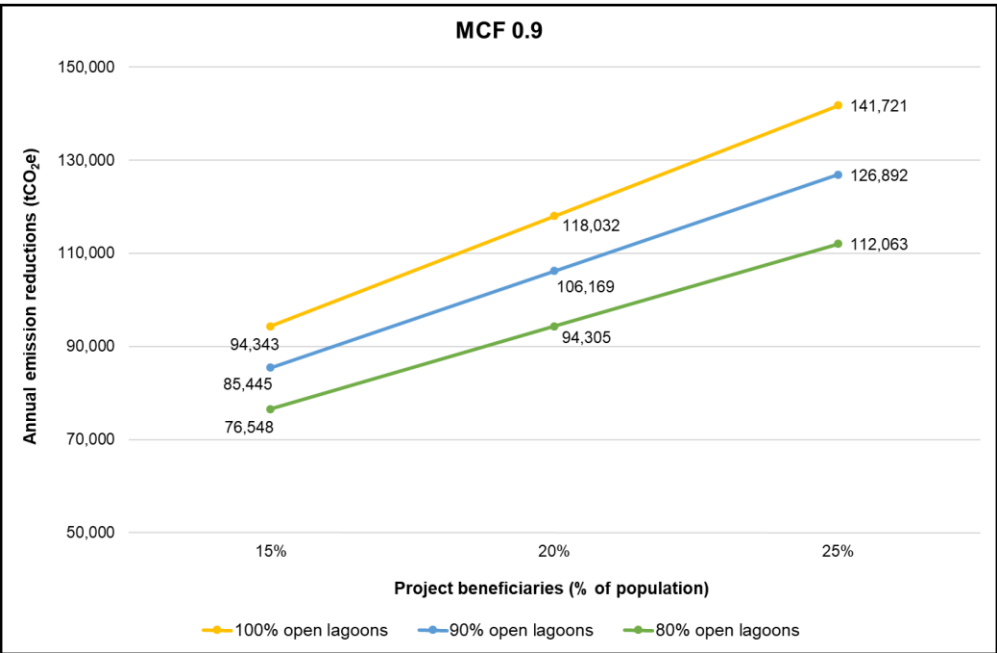


Figure 3. Sensitivity analysis of GHG emission reductions under a constant baseline MCF of 0.9 (Case 3)



Case 1: Sensitivity analysis considering variations in project beneficiaries (15%, 20%, and 25%) and baseline MCF = 0.8

a) 100% wastewater treated in open lagoons under the baseline

Project beneficiaries (% of population)	Wastewater treated in open lagoons in baseline (%)	MCF	Annual emission reduction (tCO ₂ e/year)	Lifetime emission reduction (tCO ₂ e)	% of emission reduction variation
15 (-5%)	100	0.8	84,457	2,533,703	-19%
20 (base case)	100	0.8	104,850	3,145,513	-
25 (+5%)	100	0.8	125,244	3,757,322	+19%

b) 90% wastewater treated in open lagoons under the baseline

Project beneficiaries (% of population)	Wastewater treated in open lagoons in baseline (%)	MCF	Annual emission reduction (tCO ₂ e/year)	Lifetime emission reduction (tCO ₂ e)	% of emission reduction variation
15 (-5%)	90 (-10%)	0.8	76,548	2,296,439	-27%
20 (base case)	90 (-10%)	0.8	94,305	2,829,161	-10%
25 (+5%)	90(-10%)	0.8	112,063	3,361,882	+7%

c) 80% wastewater treated in open lagoons under the baseline

Project beneficiaries (% of population)	Wastewater treated in open lagoons in baseline (%)	MCF	Annual emission reduction (tCO ₂ e/year)	Lifetime emission reduction (tCO ₂ e)	% of emission reduction variation
15 (-5%)	80 (-20%)	0.8	68,639	2,059,175	-35%
20 (base case)	80 (-20%)	0.8	83,760	2,512,808	-20%
25 (+5%)	80 (-20%)	0.8	98,881	2,966,441	-6%

Case 2: Sensitivity analysis considering variations in project beneficiaries (15%, 20%, and 25%) and baseline MCF = 0.7

a) 100% wastewater treated in open lagoons under the baseline

Project beneficiaries (% of population)	Wastewater treated in open lagoons in baseline (%)	MCF	Annual emission reduction (tCO₂e/year)	Lifetime emission reduction (tCO₂e)	% of emission reduction Variation
15 (-5%)	100	0.7 (-10%)	74,571	2,237,123	-29%
20 (base case)	100	0.7 (-10%)	91,669	2,750,072	-13%
25 (+5%)	100	0.7 (-10%)	108,767	3,263,022	+4%

b) 90% wastewater treated in open lagoons under the baseline

Project beneficiaries (% of population)	Wastewater treated in open lagoons in baseline (%)	MCF	Annual emission reduction (tCO₂e/year)	Lifetime emission reduction (tCO₂e)	% of emission reduction Variation
15 (-5%)	90 (-10%)	0.7 (-10%)	67,651	2,029,517	-35%
20 (base case)	90 (-10%)	0.7 (-10%)	82,442	2,473,264	-21%
25 (+5%)	90(-10%)	0.7 (-10%)	97,234	2,917,011	-7%

c) 80% wastewater treated in open lagoons under the baseline

Project beneficiaries (% of population)	Wastewater treated in open lagoons in baseline (%)	MCF	Annual emission reduction (tCO₂e/year)	Lifetime emission reduction (tCO₂e)	% of emission reduction Variation
15 (-5%)	80 (-20%)	0.7 (-10%)	60,730	1,821,911	-42%
20 (base case)	80 (-20%)	0.7 (-10%)	73,215	2,196,456	-30%
25 (+5%)	80 (-20%)	0.7 (-10%)	85,700	2,571,001	-18%

Case 3: Sensitivity analysis considering variations in project beneficiaries (15%, 20%, and 25%) and baseline MCF = 0.9

a) 100% wastewater treated in open lagoons under the baseline

Project beneficiaries (% of population)	Wastewater treated in open lagoons in baseline (%)	MCF	Annual emission reduction (tCO₂e/year)	Lifetime emission reduction (tCO₂e)	% of emission reduction Variation
15 (-5%)	100	0.9 (+10%)	94,343	2,830,284	-10%
20 (base case)	100	0.9 (+10%)	118,032	3,540,953	+13%
25 (+5%)	100	0.9 (+10%)	141,721	4,251,622	+35%

b) 90% wastewater treated in open lagoons under the baseline

Project beneficiaries (% of population)	Wastewater treated in open lagoons in baseline (%)	MCF	Annual emission reduction (tCO₂e/year)	Lifetime emission reduction (tCO₂e)	% of emission reduction Variation
15 (-5%)	90 (-10%)	0.9 (+10%)	85,445	2,563,361	-19%
20 (base case)	90 (-10%)	0.9 (+10%)	106,169	3,185,057	+1%
25 (+5%)	90 (-10%)	0.9 (+10%)	126,892	3,806,752	+21%

c) 80% wastewater treated in open lagoons under the baseline

Project beneficiaries (% of population)	Wastewater treated in open lagoons in baseline (%)	MCF	Annual emission reduction (tCO₂e/year)	Lifetime emission reduction (tCO₂e)	% of emission reduction Variation
15 (-5%)	80 (-20%)	0.9 (+10%)	76,548	2,296,439	-27%
20 (base case)	80 (-20%)	0.9 (+10%)	94,305	2,829,161	-10%
25 (+5%)	80 (-20%)	0.9 (+10%)	112,063	3,361,882	+7%